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SHORTER NOTES

A TERATOLOGICAL NOTE ON TIMOTHY.—The usual farm crops afford many instances of double (and sometimes triple) fruits. Such specimens of red clover and field corn are rather common. I have never noticed such abnormalities in timothy, however, until this year, when a partially double head of timothy was found in our lane. The whole head is 7.6 cm. long, being single for 4 cm. of its length and having the upper part divided into two stalks of 3.6 cm. each. The upper divisions are almost equal in diameter to the basal part, and are fully fruited, except occasionally on the inner sides. The divisions diverge at an angle of 35 degrees.

H. R. ROMINE.

ABNORMALTIES IN THE RADISH, CLOVER, AND ASH.—Several seedlings of the radish grown by our students this year in their seed germination studies had one cotyledon some distance below the other; in one instance the cotyledons were 3 cm. apart. A specimen of white clover, *Trifolium hybridum*, was found along the roadside this June with seven large flowerets 2.3 cm. below the head itself. The flowerets of the head were perhaps not so numerous as usual. From an American ash tree near our school buildings I picked several leaves which to me seemed very unusual. There were two sets of leaflets instead of one set at the nodes along the rachis; some had three pairs of such doubles instead of three pairs of leaflets.

EMMELINE MOORE.

NEW JERSEY STATE NORMAL SCHOOL.

REVIEWS

Knuth's Handbook of Flower Pollination*

The first volume of this series containing 381 pages and 81 figures appeared last year. It considers the modes of pollination and the types of flowers and their insect visitors, special attention being given to their structure and mutual adaptability.

* Knuth, Paul. Translated by J. R. Ainsworth. Volume II, Handbook of Flower Pollination, Large 8vo, viii + 703. f. 1-210. 1908. Oxford, Clarendon Press. Cloth 31s. 6d. Half morocco, 35s. net.

The second volume with a portrait of Hermann Müller, upon whose studies the series is based, has now appeared. This volume is special in nature and contains "an account of all known observations upon the pollination of the flowers of plants of Arctic and Temperate zones." From the contents, however, we infer that it is devoted to certain groups of dicotyledones ranging from the Ranunculaceae to the Stylidiaceae. The sequence of the groups is somewhat different from the arrangement with which we are familiar and to give an idea of their arrangement and of the scope of the work mention may be made of the more important orders and families, employing the classification in common use in this country: Ranales, Papaverales, Violaceae, Polygalaceae, Caryophyllaceae, Portulacaceae, Hypericaceae, Malvales, Geraniales, Sapindales and Rhamnales, Rosales, Myrtales, Passifloraceae, Cucurbitaceae, Cactaceae, Umbellales, Rubiales, Valerianales, and Compositae which includes our Carduaceae and Cichoriaceae.

The remaining families and orders will be discussed in the third volume, while the fourth and final volume has been advertised to deal similarly with plants outside Europe. The orders mentioned above are not recognized in the discussion, the species being arranged in fifty-six orders that correspond to our families. For example the Ranales are discussed under six orders and the Sapindales and Rhamnales are represented by six orders promiscuously intermingled. The families (orders) of an alliance are also very generally taken up in the reverse order of their complexity. The rose group begins with the Leguminosae and follows with the Rosaceae, Saxifrageae, and Crassulaceae, though the Myrtales may possibly be cited as a reversal of this treatment in which the reduced Halorrhagidaceae (Halorageae in the text) are followed by the Melastomaceae, Lythraeae, and Onagraceae. Just what purpose the authors had in mind by this reversion of sequence — of going up the biological scale backward so to speak — is not clear. We take it that an attempt has been made to represent in this arrangement of the families, their natural relationship. In some cases the sequence is a very probable one, as from the Umbellales to the Rubiales, Valerianales, and Compositae; but in other cases the arrangement is unusual to

say the least, as for example the association of the Violaceae, Polygalaceae, and Caryophyllaceae, in the order given, these groups following the Resedaceae and leading to the Hypericaceae. No attempt has been made to comply with the terminology now commonly employed and we find the so called orders ending in a great array of final syllables, partially illustrated above in the references to the rose and myrtle alliances.

The illustrations are deficient in number and lacking in quality. A criticism of this nature need rarely be passed on the superb book work of the Clarendon Press ; indeed, it seems a pity to mar so excellent a book as this with inferior drawings which at times might almost be termed grotesque. Little care has been bestowed upon the size of the figures. A diagram of *Lythrum*, dealing with only gross morphological characters, is given a half page, while many illustrations of Cruciferae, Rosaceae, etc. are so reduced as to obscure the relationship of the organs. The figures are often overshadowed with the result that they lack clearness or are even smudgy.

The only means of referring to the numerous species in the text is to be found in the index of the fifty-six orders that follows the title page. We understand that a full index will be included in the final volume but the publishers should have recalled that this volume will be extensively used by students as a reference book and that the lack of an index is a serious disadvantage. A similar deficiency is the lack of a glossary, especially since terms are employed that are not universally current.

The above criticisms, however, are of minor consideration and are not intended to reflect upon the excellence and worth of the discussion. The treatment accorded the orders, genera, and species will be universally appreciated by those interested in this phase of botany. The citation of the literature, and the discussions of the morphological and biological features of the flower, make the book indispensable as a work of reference. Much adverse comment has been passed upon ecological studies of this nature that have been so well developed upon the continent. We feel, however, that they are of great importance and know of no better way of introducing the study of flowering plants to

the student and of arousing his interest in it. Furthermore, it is worth one's time to learn the real significance of the morphology of the flower and to understand that it has a purpose other than to furnish means for the identification of the plant.

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OF INTEREST TO TEACHERS

QUANTITATIVE WORK IN HIGH SCHOOL SCIENCE COURSES

BY JULIUS SACHS

From the general standpoint of the object of secondary education, and not from the point of view of a science expert, I offer you a few comments on the influence of quantitative work in our high school science courses. It is claimed that no science is worth teaching, especially no physics, that does not make for quantitative accuracy; the college officers, however, who imbue the future teachers with this view, know very little of the hesitancy and helplessness of our high-school students; they do not know, as teachers of long experience know, that the steps of the students must be carefully directed in their experimentation, and that there is much more than unaided performance in the observations they record. It is safe to say that even if the students grasp the topics handled in this mathematico-physical work, they certainly fail of seeing the larger relations of the individual experiment to the world of physical phenomena. I am inclined to reverse the usual estimate that teachers place on the relative importance of their work in the high school; to me the most valuable and most important part of the work is that effected with pupils who cannot or will not advance to the college stage; for them surely, and I should like to add for *all* high-school students, it is important that they should be led to comprehend the physical, chemical, and biological elements that enter into the various industrial, agricultural, and mechanical problems. If then you wish to add a special fundamental training along the line of quantitative work, let that constitute an advanced course